

MIPAS

Michelson Interferometer for Passive Atmospheric Sounding

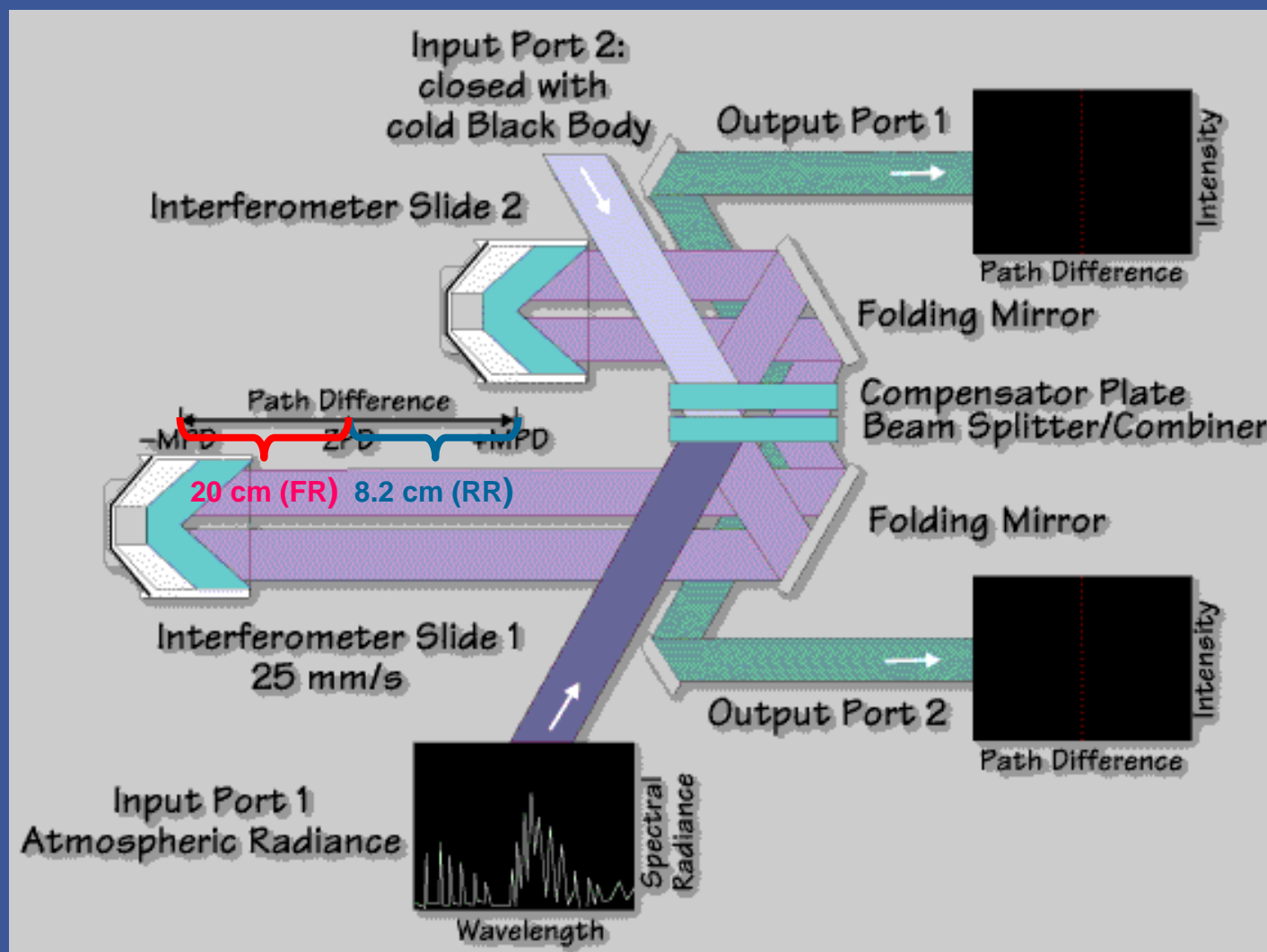
The MIPAS Team presented by T. Fehr

Aura Workshop, The Hague, 8 November 2005



Thorsten.Fehr@esa.int

***European Space Agency
Agence spatiale européenne***





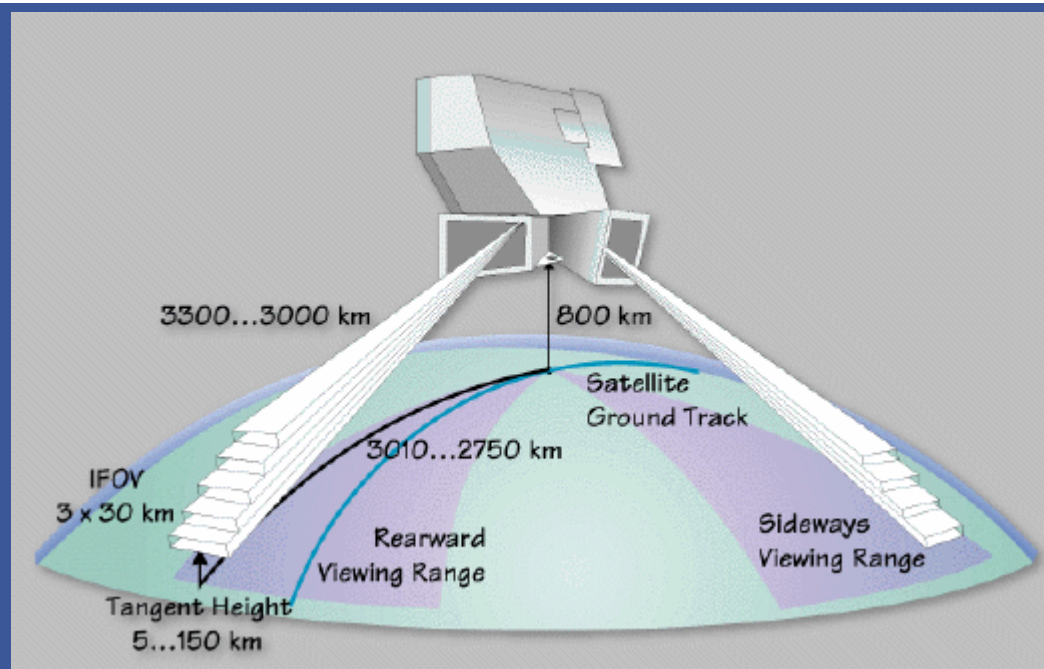
Spectral range:
4.1 – 14.6 μm

Spectral resolution:
0.035 cm^{-1} (FR)
0.0625 cm^{-1} (RR)

Altitude range:
Nominal mode: 6 – 68 km
other observation modes

Coverage:
Global, pole to pole

Measurement schedule:
Continuous until 2004
Discontinuous at present
(35% duty cycle)



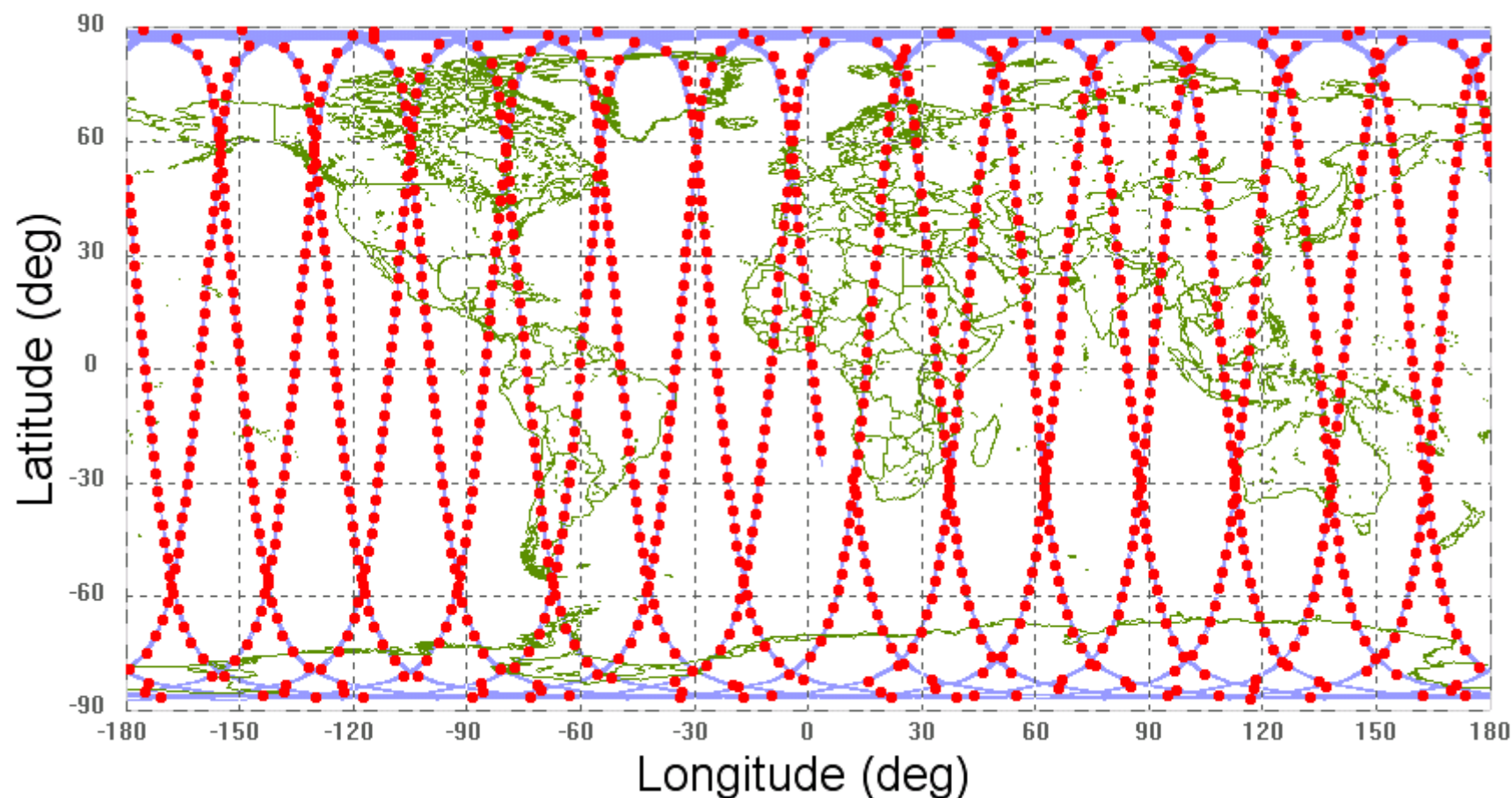
Measurement products:

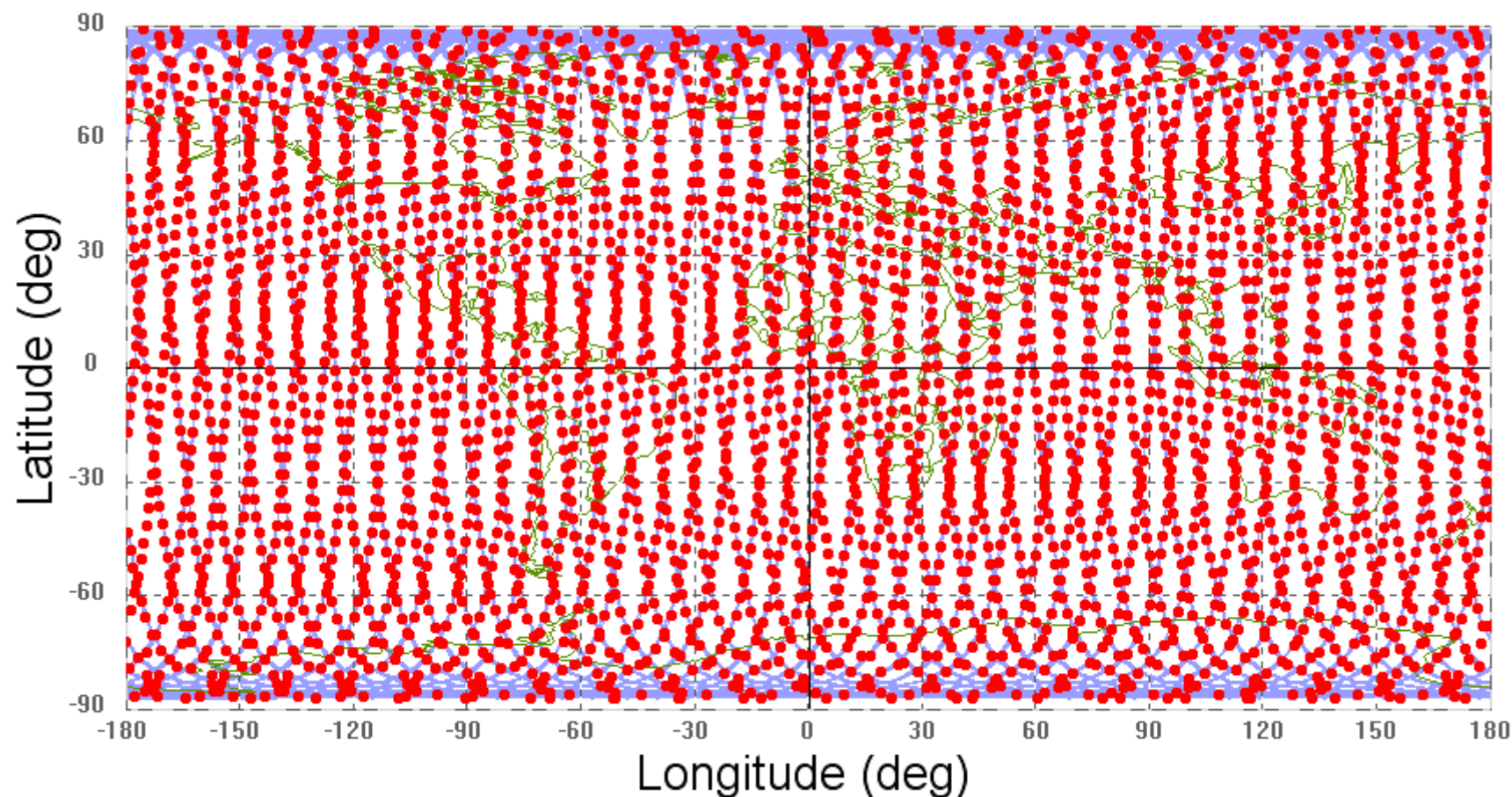
Operational:

p , T , H_2O , O_3 , CH_4 , N_2O , HNO_3 , NO_2

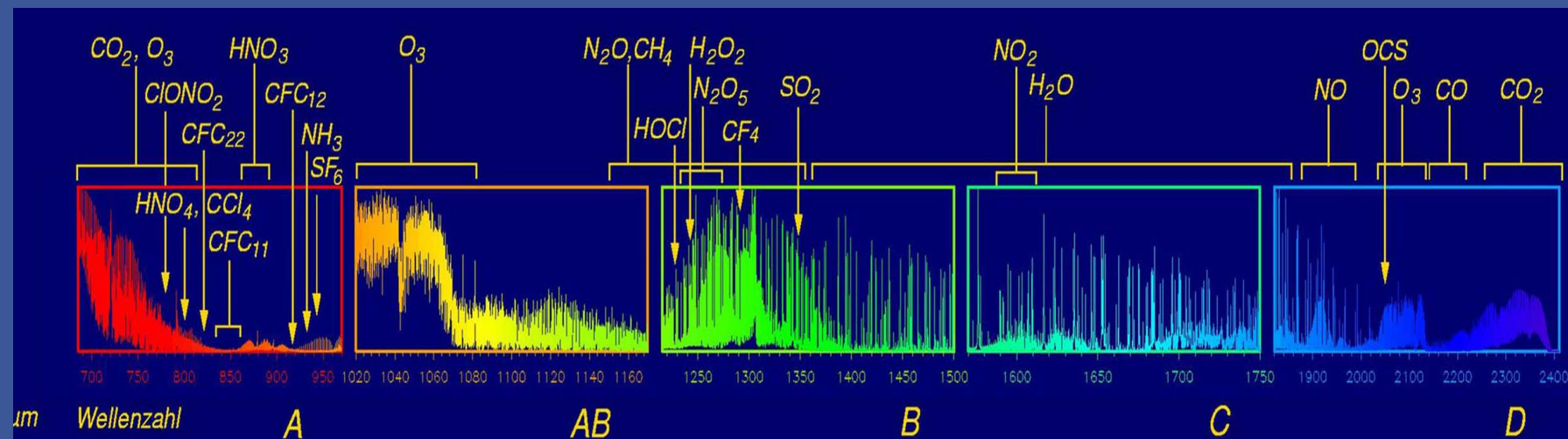
Scientific:

NO , N_2O_5 , HNO_4 , ClONO_2 , ClO , CO ,
 CFCs , NH_3 , C_2H_6 , HDO ,
 O_3 isotopomers and others
(more than 25 parameters)





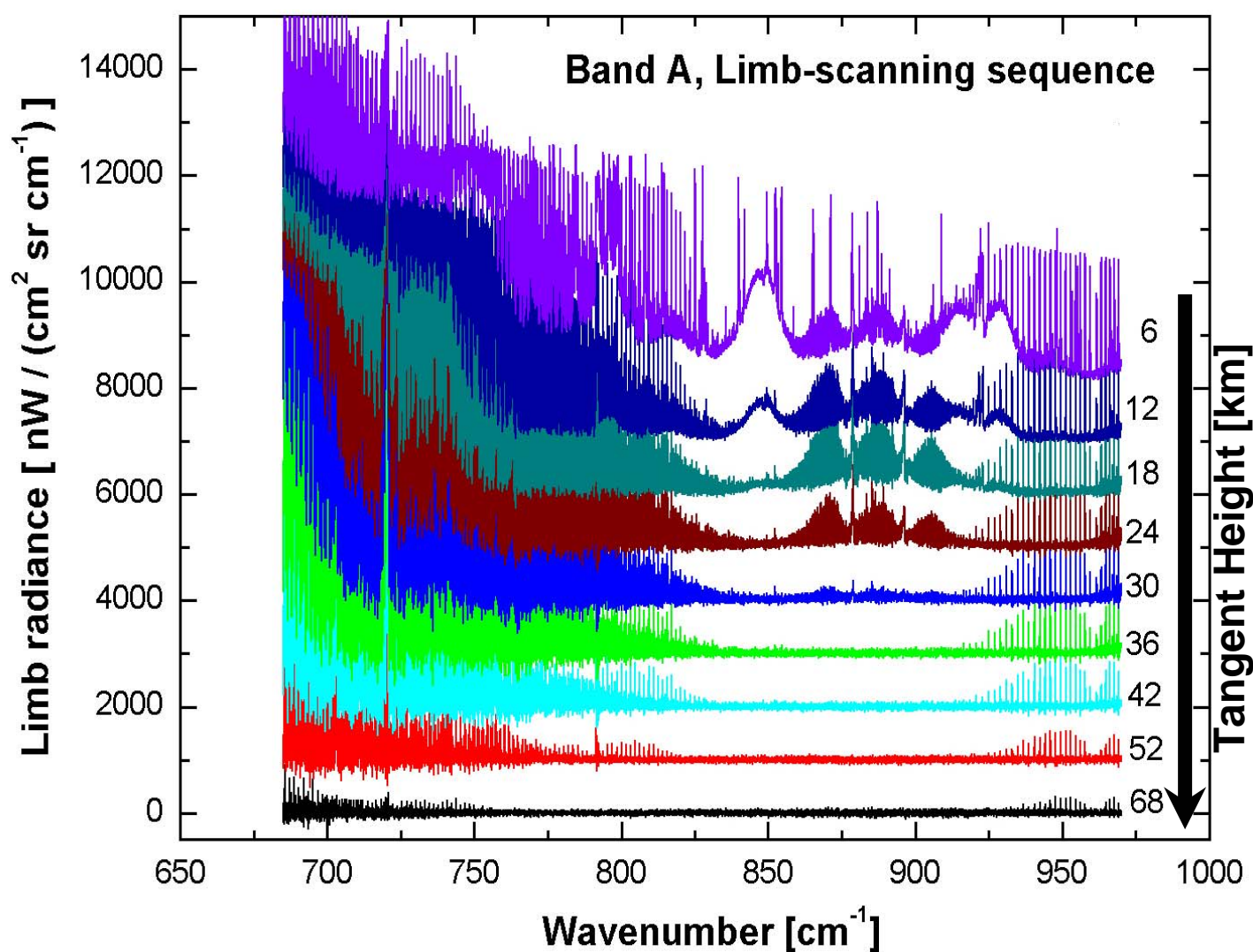
- 1. Chemistry and Dynamics of the Stratosphere**
ozone depletion, partitioning of compounds, PSCs
- 2. Stratospheric/Tropospheric exchange**
upward transport in tropics, polar subsidence
- 3. Chemistry of the Upper Troposphere**
vertical transport of polluted air from PBL
- 4. Mesosphere and Lower Thermosphere**
carbon budget in the upper atmosphere, ozone in the mesosphere
non-LTE parameters, solar storm effects
- 5. Climatology and Weather Forecasting**
temperature and ozone in the stratosphere for data assimilation

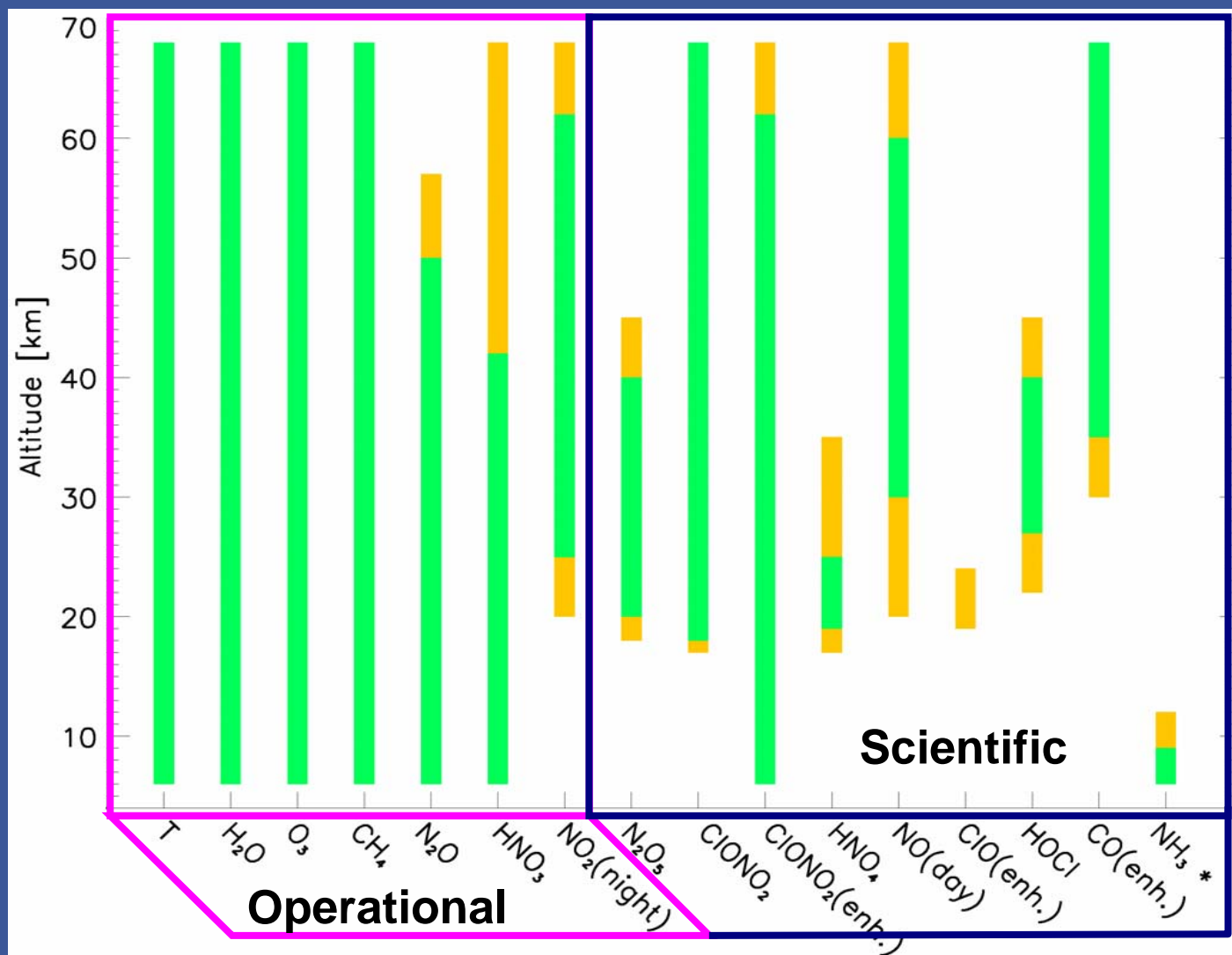


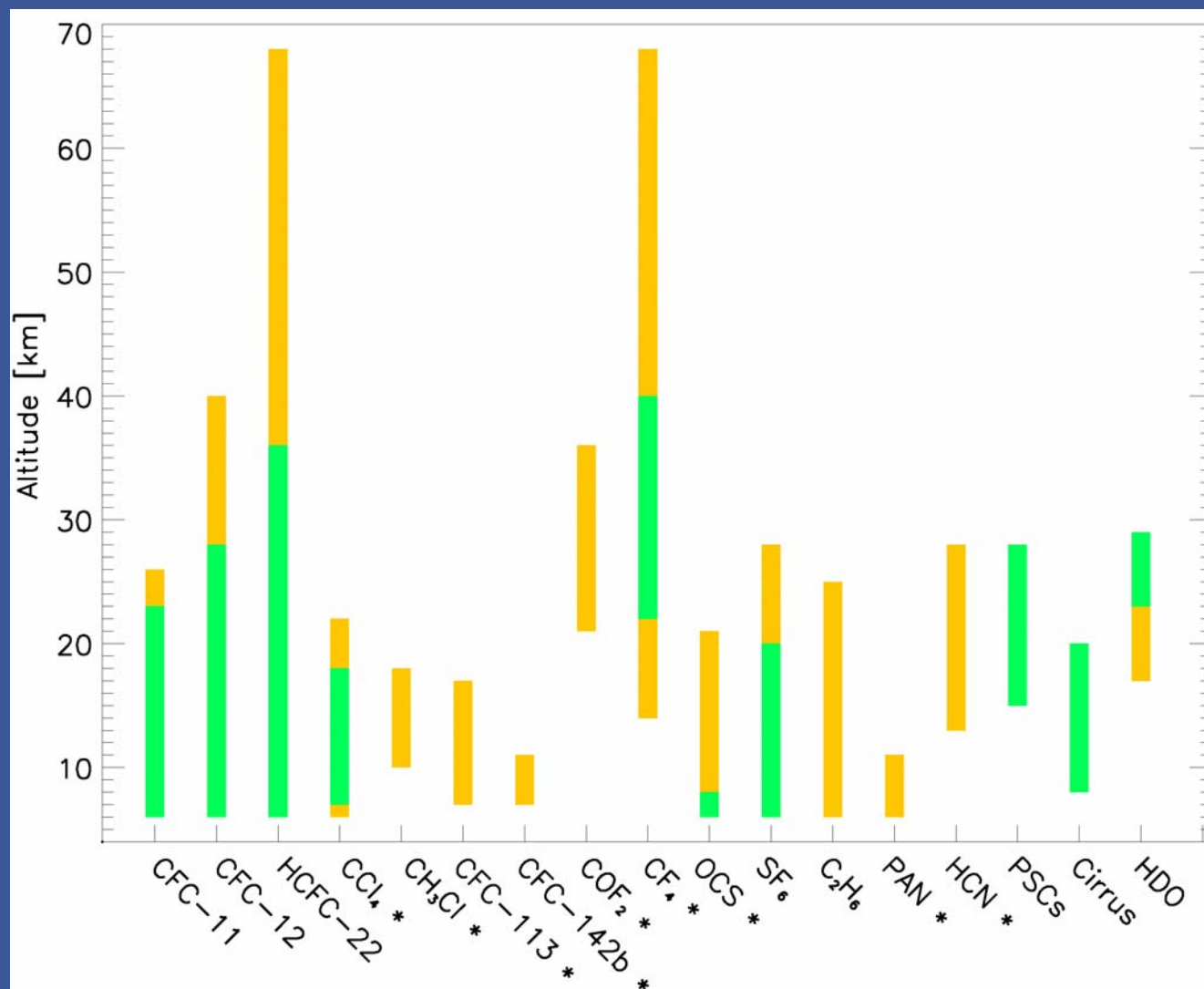
685 cm⁻¹
14.6 μm

Spectrum at 28 km tangent altitude

2410 cm⁻¹
4.15 μm







1. Measurement performance

- Excellent radiometric and spectral performance (exceeding specs)

2. December 2002: Cooler anomalies

- Resolved through bypassing automatic compensation software, and performing manual balancing of the two sterling cooler units.

3. March 2003: First sparse interferometer instabilities, gradually increasing in frequency

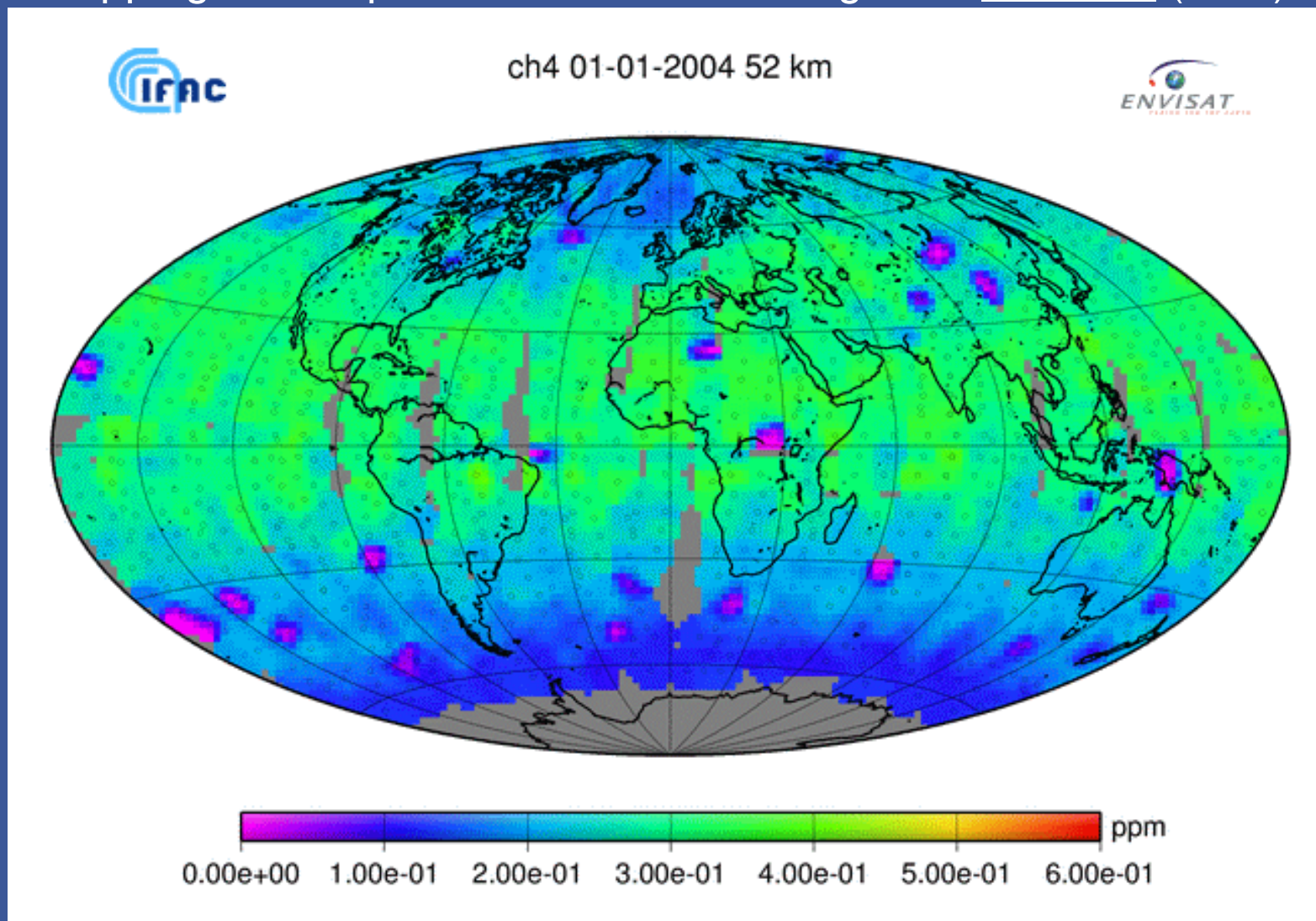
- Mission interruptions for investigations since mid 2004

4. January 2005 systematic operations have resumed with

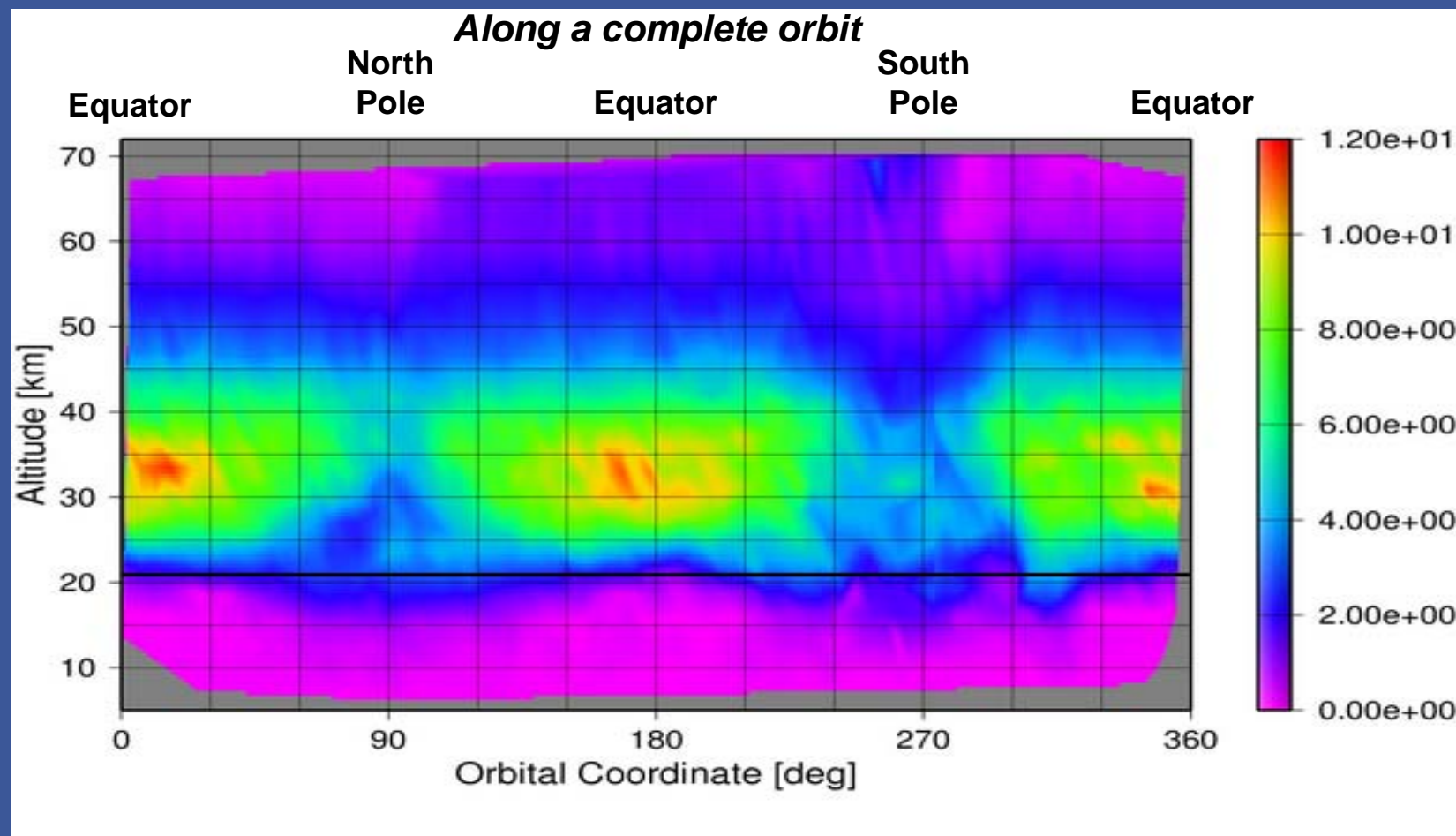
- Reduced duty cycle (35% of time “on”, 65% “off”)
- Reduced spectral resolution (40.99%)
- Denser geographical sampling (altitude, latitude)

1. Current Operational Data Processor: 4.63
2. Adaptation to reduced resolution available for level 1B, including calibration improvements
3. Algorithm Adaptation for Level 2 is underway
4. Currently all level 0 are stored
5. Level 1B processing begins after 4.65 installation (this month)
6. Level 2 processing will resume 2006 (including all backlog)
7. Full-Resolution Mission reprocessing (July 2002 – March 2004) completed, data available online via ftp

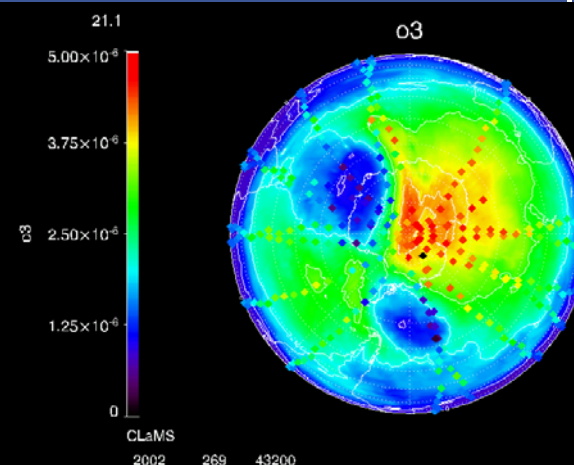
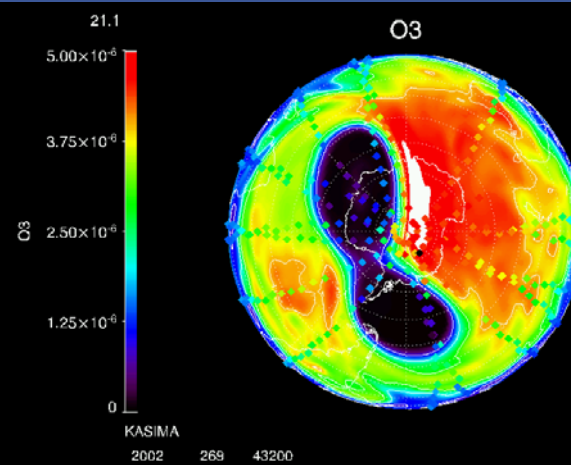
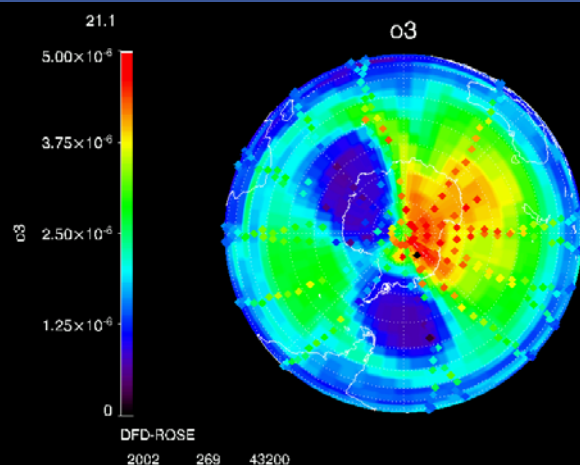
Mapping the 3D profile of different trace gases: Methane (CH₄)



Mapping the 3D profile of different trace gases: Methane (CH₄)



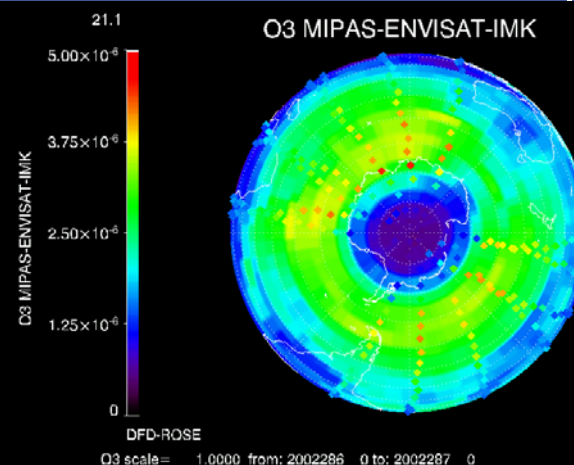
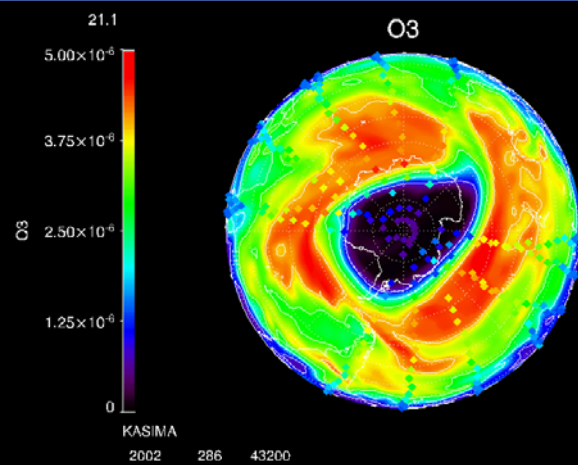
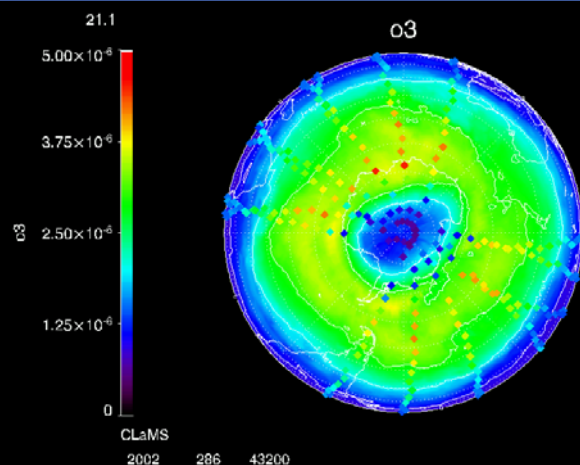
Ozone distribution at 50 hPa 26.09.02 [top] / 13.10.02 [bottom]



CLaMS

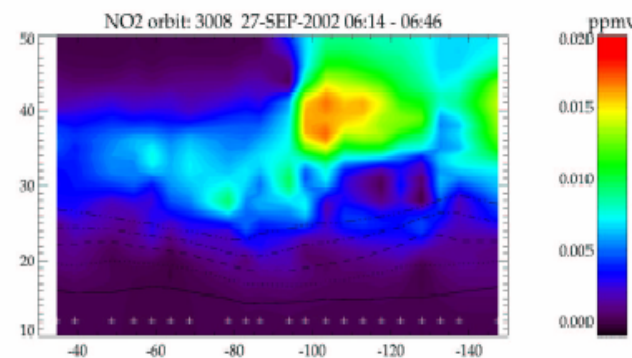
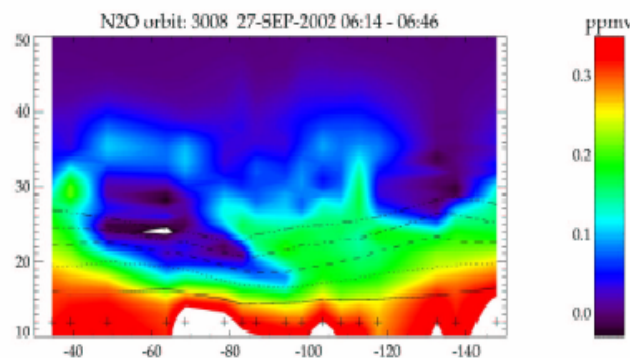
KASIMA

DLR-ROSE



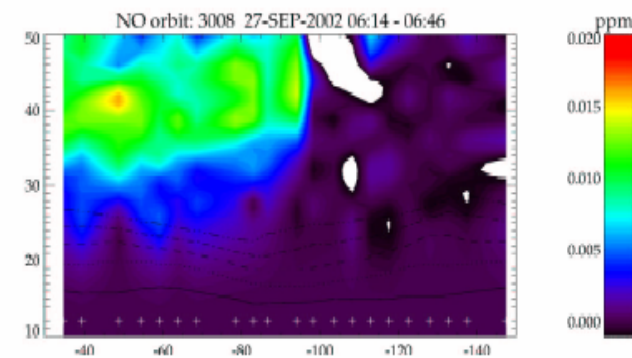
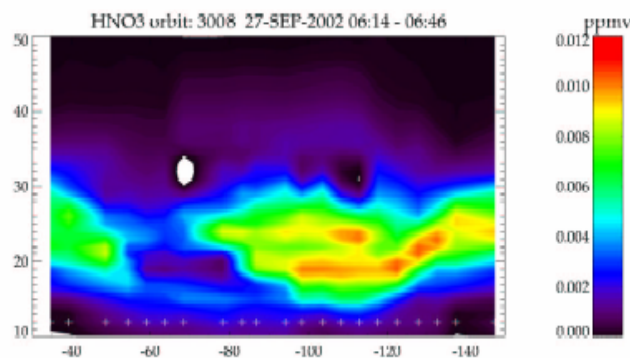
27/09/2002

N₂O



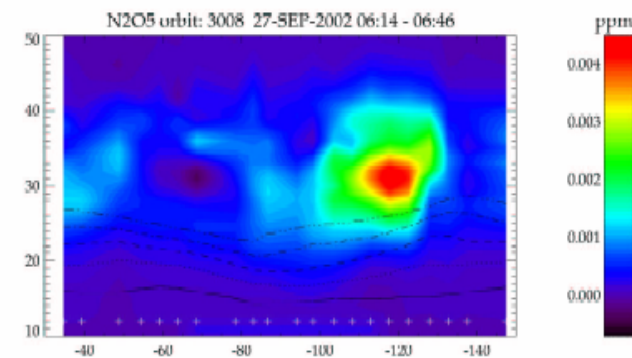
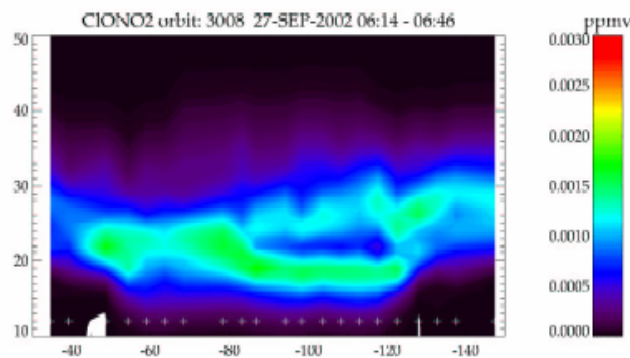
NO₂

HNO₃



NO

ClONO₂



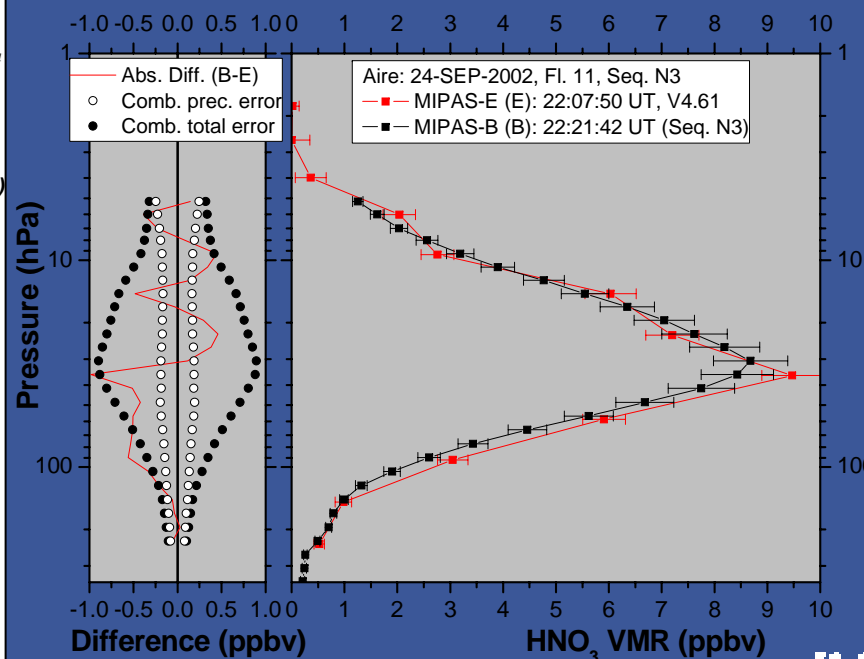
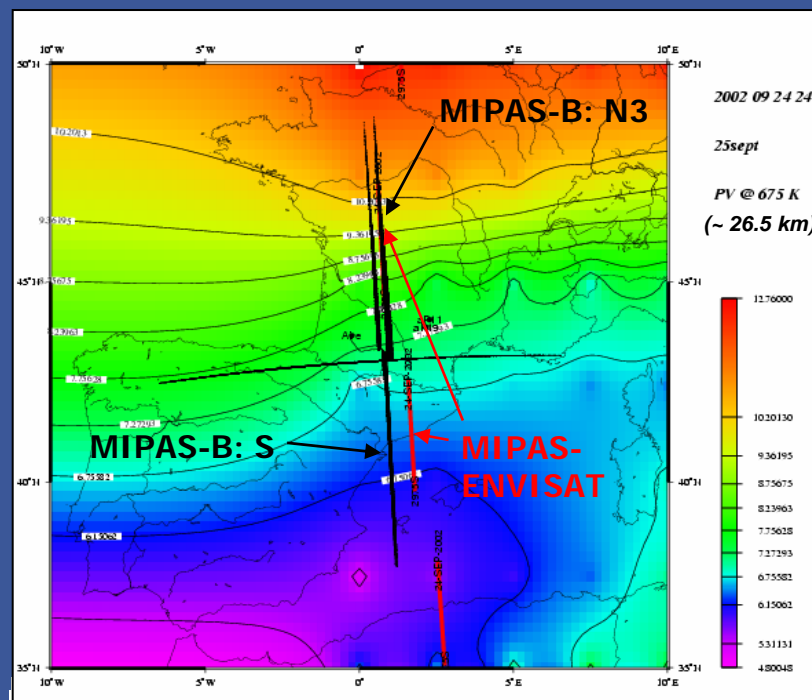
N₂O₅

Ongoing Activity

Example: Balloon Campaign

Aire, 43°N, 24 Sep. 2002 (Fl. 11):

→ Perfect coincidence in terms of time and location



IMK, Karlsruhe



Polar stratospheric clouds (PSCs):

- **Discovery of a nitric acid trihydrate (NAT) PSC belt around Antarctica caused by mountain waves**
(Höpfner et al., ACPD, 2005a)
- **Spectroscopic evidence for β -NAT as constituent of Type 1a PSCs**
(Höpfner et al., ACPD, 2005b)

Solar Proton Event (SPE) November 2003:

- **First detection of SPE induced enhancements of HOCl, N_2O_5 , $ClONO_2$ (apart from NO_x , HNO_3 , and reduction of O_3) and identification of two different chemical processes**
(López-Puertas et al., JGR, 2005a, 2005b; v. Clarmann et al., JGR, 2005)

Downward transport of NO_x from the upper atmosphere:

- **NO_x intrusion in Antarctic winter 2003 from UA = 9% of annual SH production of NO_y by N_2O oxidation**
(Funke et al., JGR, 2005)
- **Secondary Antarctic mid-winter HNO_3 maximum can be related to downward transport of NO_x and conversion via ion cluster chemistry**
(Stiller et al. JGR, 2005)

Early Antarctic vortex split 2003:

- First space-borne observation of ClO by mid-IR limb emission spectroscopy
(Glatthor et al., JGR, 2004)
- First space-borne observations of springtime Antarctic stratospheric ClONO₂ reveals unusual recovery of chlorine into ClONO₂
(Höpfner et al., JGR, 2004)
- Quantification of NO_y partitioning and denitrification
(Mengistu Tsidu et al., JGR, 2005)

Upper troposphere / lower stratosphere H₂O:

- Discovery of global subtropical bands of enhanced water vapor at around 18 km with maximum values over the Arabic peninsula
(Milz et al., JGR, 2005)

Application for Category 1 use data access can be submitted to ESA at any time using the ESA Earth Observation Principal Investigator portal (already established for OMI).



The screenshot shows the ESA Earth Observation Principal Investigator Portal (EOPi) interface. The top navigation bar includes links for Principal Investigator, Evaluator, Correspondent, and Contact us. The main content area displays various data access options, including Monitoring aerosol particles density from space, Coincident cloud observations by altimetry and radiometry, Agriculture and Land Use Monitoring in the Province, Operational Land Surface Temperature from AATSR, and Behaviour of an anticyclonic. The left sidebar contains links for Results & News, News, Search, Focus on PI, Round table, AO Submission, Cat-1 & Open AOs, Previous AOs, Update & Reporting, Services, About this site, ESA Data Policy, FAQ, Related Links, and How to get ESA data. The bottom of the page features the Living Planet logo and copyright information.

When the requested data is systematically available on ESA Internet servers, e.g. MIPAS :
→ **Registration** (i.e. a simplified proposal)

When the requested data is related to specific acquisition or dissemination constraints (e.g. ASAR High Rate data) :
→ **Project proposal**
The proposal is submitted to a peer review process [about 8 weeks before acceptance notification]

Terms and conditions:

- to use the data provided for Category 1 use only **within the project team** (i.e. PI and co-PIs) and only for the purpose described in the project proposal
- to widely **publish** the project results in **scientific publications** or presentations (with data citation: “[*mission or instrument*] Data provided by European Space Agency”)

- ❑ **Largest European satellite & largest worldwide EO satellite:**
 - ❑ unique combination of 9 instruments addressing land, ocean, ice and atmosphere studies,
 - ❑ instruments working nominally, except for MIPAS (discontinuous operations) and GOMOS (but workaround found).
- ❑ **78 different types of data products**
250 Gigabytes of data products generated per day
- ❑ **Satellite OK with mid-term operations capabilities:**
 - ❑ 65 % of hydrazine available,
 - ❑ the on-board hydrazine is the main limiting factor for the mission lifetime
- ❑ **Operations funding expected until 2010**

More on MIPAS at the Aura Workshop:

- Thu. 08:45, The First two years of the MIPAS/ENVISAT mission: Scientific results related to the upper troposphere and lower stratosphere (UTLS), Gabriele P. Stiller
- Thu., 15:00 Origin of the January-March 2004 strong NO₂ enhancement in the northern polar stratosphere using MIPAS and GOMOS data, Jean-Baptiste Renard
- Poster: Massimo Carlotti, GMTR: Two-Dimensional Multi-Target Retrieval Model for MIPAS/ENVISAT Observations
- Poster: Bernd Funke, The first two years of the MIPAS/ENVISAT mission: Scientific results related to the stratosphere and mesosphere
- Poster: Thorsten Fehr, The ENVISAT Atmospheric Chemistry Mission: Status and Performance
- Poster: Mathias Milz, Measurements of water vapour with MIPAS/Envisat
- Poster: Yvan Orsolini, MIPAS Observations of Stratospheric Impacts of Solar Storms
- Poster: Jörg Steinwagner, Global distribution of water isotopes retrieved from MIPAS measurements
- Poster: Gabriele P. Stiller The first two years of the MIPAS/ENVISAT mission: Scientific results related to polar ozone chemistry
- Poster: Joanne Walker, MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) and MLS carbon monoxide retrievals compared